Differential in Risky Asset Ratios between the United States and Japan

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Differential in Risky Asset Ratios between the United States and Japan[a]

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【Abstract】

The ratio of risky assets to wealth is much lower in Japan than in the US. The purpose of this paper is to elucidate the cause of the differential in the risky asset ratios between the two countries using a household survey. Estimating the relative risk tolerance and demand functions for risky assets reveal that the risk tolerance hypothesis that the cause is the differential in the risk tolerance was rejected. This study also found that a large part of the differential in the risky asset ratios depended on factors that have not been explicitly considered in previous studies.

JEL Classification: D81; G11

【Key Words】

Differential in Risky Asset Ratios; Relative Risk Tolerance; Hypothetical Income Gamble; Household Survey

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1. Introduction

Japanese households hold a lower ratio of risky assets such as stocks and investment trusts as a proportion of wealth compared with US households. A simple hypothesis is that the cause is the differential in attitudes toward risk between the US and Japan[1]. For the risk tolerance hypothesis to be correct, the following two conditions must be satisfied: (i) risk tolerance is positively correlated with risky asset ratio, and (ii) the risk tolerance of Japanese households is lower than that of US households.

Rosen and Wu (2004) and Heaton and Lucas (2000b) have discussed condition (i) for US households. Constructing the risk attitude variable from the survey responses about gambles over lifetime income in the Health and Retirement Study (HRS), Rosen and Wu (2004) found that the more risk-tolerant households tend to have a higher risky asset ratio. Using the Survey of Consumer Finances (SCF), Heaton and Lucas (2000b) found the same result. However, there has been no study on Japanese households, and condition (ii) has never been investigated in the either the US or Japan.

To find out the cause of the differential, this paper involves four steps. First, I estimate relative risk tolerance from the survey results and test whether the risk tolerance hypothesis is correct. Second, I calculate the value of the risky asset ratio predicted by Merton (1969) and Samuelson (1969)'s classical theory and check whether it is consistent with the observed risky asset ratio. If they do not match, it means that determinants other than those in the classical theory affect the observed risky asset ratio and may become causes of the differential. Third, I estimate the demand function for risky assets to see whether determinants other than those in the classical theory affect the observed risky asset ratio. Finally, using the estimation result of the demand function, I decompose the differential into two components, the component affected by differences in the level of the independent variables and the component affected by differences in the sensitivity of the risky asset ratio to the independent variables. Then, I estimate the magnitude of these two components.

The remainder of the paper is organized as follows. Section 2 describes the first step analysis, and it is revealed that the risk tolerance hypothesis is rejected. Section 3 deals with the second step analysis, and it is found that there is a difference between the theoretically predicted and the observed value of the risky asset ratio. This means that the risky asset ratio depends on factors other than the determinants in the classical theory. Section 4 reports on the third step analysis and demonstrates that the estimation results of the demand function for risky assets are largely consistent with the results of the previous research. Section 5 deals with the fourth step analysis, and it is revealed that a large part of the differential depends on factors that are not considered explicitly in the regression. Section 6 offers conclusions.

2. Risky Asset Ratios and Risk Tolerance Hypothesis

This paper uses the results of the "Preferences and Life Satisfaction Survey" in the US and Japan conducted by Osaka University in February 2005. The number of respondents

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[1] This hypothesis is based on the idea of Friend and Blume (1975), who analyzed risky asset holdings in the US. In their paper, the risky asset ratio in itself is regarded as the proxy for relative risk tolerance.

were 4979 and 2987 in the US and Japan, respectively. In this survey, the following question was asked about the respondents' financial assets holdings.

- What percentage of your financial assets of your entire household are in the investment trusts, stocks, futures/options, corporate bonds, foreign currency deposits, and government bonds of foreign countries?

Denoting the answer to this question by α, the risky asset ratio is defined as follows[2].

$$Ratio \equiv \frac{\alpha \times Financial\,Asset}{Wealth} \#(1)$$

This study regards investment trusts, stocks, futures/options, corporate bonds, foreign currency deposits, and government bonds of foreign countries as risky assets[3]. Figure 1 shows the frequency of the *Ratios* in the US and Japan. The *Ratio* is below 10% for more than 80% of Japanese households, while in the US the *Ratio* is below 10% for less than 60% of households. Furthermore, the mean value of the *Ratio* in Japan is only 3.8% whereas in the US it is 16.2%, and the difference in the mean is significant at the 1% level. It is clear that a differential exists.

A simple hypothesis is that the cause is the differential in attitudes toward risk between the US and Japan. Specifically, this means that Japanese households are less risk tolerant than US households and therefore the risky asset ratio for Japanese households is lower than that for US households. In order for the hypothesis to hold, the following two conditions must be satisfied at least: (i) risk tolerance is positively correlated with the risky asset ratio, and (ii) the risk tolerance of Japanese households is lower than that of US households.

Rosen and Wu (2004) and Heaton and Lucas (2000b) have discussed condition (i) for US households. Constructing the risk attitude variable from the survey responses about gambles over lifetime income in the Health and Retirement Study (HRS), Rosen and Wu (2004) found that the more risk-tolerant households tend to have a higher risky asset ratio. Using the Survey of Consumer Finances (SCF), Heaton and Lucas (2000b) found the same result. However, there has been no study on Japanese households, and condition (ii) has never been investigated in the either the US or Japan. In this section, I estimate the relative risk tolerance, and then test whether the risk tolerance hypothesis is rejected or not.

The relative risk tolerance is estimated by the method of Barsky et al. (1997) using the following questions, which are quite similar to those in the HRS[4].

- Considering the following two ways of receiving your monthly income, which

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[2] For the definition of *Wealth* and *Financial asset*, see Appendix 1.

[3] Equation (1) means that real assets are regarded as safe assets. The main conclusions of this paper remain unchanged when real assets are regarded as risky assets.

[4] Whereas Rosen and Wu (2004) constructed a risk attitude dummy variable, this paper constructs a cardinal proxy for relative risk tolerance by applying Barsky et al. (1997)'s method.

is preferable to you? Assume the job assignment is the same under these situations. If you are a dependent (e.g., student, housewife, etc.), answer this question taking your living expense as your monthly income.

1. Your monthly income has a 50% chance of doubling, but also has a 50% chance of decreasing by 30%.
2. Your monthly income is guaranteed to increase by 5%.

If the answer to this question is 1, the respondent is required to answer the next question with a higher downside risk.

1. Your monthly income has a 50% chance of doubling, but also has a 50% chance of the monthly income being cut in half.
2. Your monthly income is guaranteed to increase by 5%.

If the answer to the first question is 2, the respondent is required to answer the following question with a lower downside risk.

1. Your monthly income has a 50% chance of doubling, but also has a 50% chance of the monthly income decreasing by 10%.
2. Your monthly income is guaranteed to increase by 5%.

The questions separate the respondents, depending on their answers to the two questions, into four distinct risk preference categories, ranging from the most risk tolerant category (both answers are 1) to the most risk averse category (both answers are 2). Then, the risk tolerance in each category is obtained by maximum likelihood estimation[5].

Panel A of Table 1 shows the results of regressing the *Ratio* on the estimated relative risk tolerance and the constant term by means of a Tobit model, where the lower bound is zero (the household holds only safe assets) and the upper bound is one (the household holds only risky assets). In both Japan and the US, the coefficient on relative risk tolerance is significantly positive, indicating that condition (i) is satisfied. The mean, standard deviation, and the mean difference between the US and Japan of the estimated relative risk tolerance are shown in Panel B of Table 1. The mean values of the relative risk tolerance are 0.206 and 0.215 in Japan and the US, respectively, and there is no statistically significant difference in the relative risk tolerance between the US and Japan. These results show that the relative risk tolerance does not differ between the US and Japan although a positive correlation between the relative risk tolerance and the risky asset ratio is observed. Therefore, the risk tolerance hypothesis is rejected as one condition necessary for the hypothesis is violated.

3. The Risky Asset Ratio and Classical Theory

According to the Merton (1969) and Samuelson (1969)'s classical theory of asset allocation, if the market is perfect, there is no labor income, and the household has a Constant Relative Risk Aversion (CRRA) utility function, then the risky assets ratio is

[5] See Barsky et al. (1997) for details.

determined by the relative risk tolerance and the distribution of returns on assets as follows:

$$w_j^* = \theta_j \times \frac{E_j[R_r] - R_f}{\sigma_{r,j}^2} \#(2)$$

In the equation, θ_j is the relative risk tolerance of household j, $E_j\left[R_r\right]$ is the subjective expected value of the return on risky assets of household j, R_f is the return on safe assets, and $\sigma_{r,j}^2$ is the subjective variance of the return on risky assets of household j. W_j^* is the theoretically predicted value of the risky asset ratio.

If the classical theory is correct, the differential must be caused by a difference in any of θ_j, $E_j\left[R_r\right]$, R_f, or $\sigma_{r,j}^2$. Therefore, the cause of the differential should become apparent by comparing each determinant between the two countries. Among these determinants, the previous section has already revealed that there is no significant difference in the relative risk tolerance between the US and Japan. Hence, this section examines $E_j\left[R_r\right]$, R_f, or $\sigma_{r,j}^2$ in the two countries. $E_j\left[R_r\right]$ and $\sigma_{r,j}^2$ depend on individuals' expectations of the future return on risky assets. This paper applies the actual values as the proxy for $E_j\left[R_r\right]$ and $\sigma_{r,j}^2$.

Figure 2 illustrates the monthly annualized rate of return on the stock price index (setting the annual stock price in 2000 as 100) from March 2003 to February 2005, which is used as the proxy for the risky asset return. Figure 2 shows that the rate of return in Japan is more volatile than that in the US. Specifically, the variance is three times as large in Japan (0.27) as in the US (0.09), although the mean rates of return in the two countries are similar (17.2% and 18.1%, respectively). Figure 3 also illustrates the annualized yield on government bonds in the US and Japan as the proxy for the return on safe assets. It is clear that the yield on government bonds is always about 3% higher in the US than in Japan. In fact, the mean yields on government bonds in the US and Japan are 4.2% and 1.3%, respectively. These results show that the variance of risky asset returns and the return on safe assets are different between the two countries.

If the classical theory sufficiently explains the observed risky asset ratio, then the theoretically predicted value will coincide with the observed value. Then, it can be concluded that the cause of the differential is the differential in the variance of risky asset returns and/or in the return on safe assets. In contrast, if the theoretically predicted value does not coincide with the observed value, determinants other than those in the classical theory affect the observed risky asset ratio and may become the causes of the differential.

Means and standard deviations of the Theoretically Predicted Value (*TPV*) and the observed value (*Ratio*) in the US and Japan are shown in Table 2. The *TPV* is constructed by substituting the estimated relative risk tolerance, the mean return on risky assets and its variance, and the mean yield on government bonds into equation (2). The mean of the *TPV* in the US is 33.2%, which is much higher than the 12.3% in Japan. That is, the classical theory predicts the differential. This implies that the differential can be explained partly by the determinants in the classical theory. However, the *TPV* in Japan is more than three times greater than the *Ratio*, and the mean difference between the *TPV* and the *Ratio* is significant at the 1% level. In the US, the *TPV* is about twice as large as the *Ratio*, and the mean difference is also significant at the 1% level. These results indicate that the classical theory does not sufficiently explain the observed ratio. In other words, there are some factors other than the determinants in the classical theory that have negative effects on the observed risky asset ratio.

4. Estimation of the Demand Function for Risky Assets

The result from the previous section indicates that some determinants other than those in the classical theory affect the risky asset ratio. In fact, many studies have reported that there are many determinants of the risky asset ratio other than those in the classical theory. Heaton and Lucas (2000b) reported that asset allocation is affected by labor income risk and the correlation between the labor income and the risky assets return. They showed that households whose labor income is highly correlated with risky asset returns tend to hold less risky assets. In their argument, there are two important points. First, labor income has risks, and therefore it is not capitalized fully in financial markets. Owing to uncertainty regarding future labor income, it is difficult to borrow against it and consume now. As a result, households under such a borrowing constraint hold less risky assets. Second, when labor income is correlated with the risky asset return, the labor income can be regarded as a risky asset. In this case, the risky asset ratio becomes lower if the households earn their income from an occupation whose payment is highly correlated with risky asset returns.

Haliassos and Michaelides (2003) investigated the relationship between costs for acquiring information about the stock market and the risky asset holdings. They showed that if the cost is high for a household, the household holds less risky assets or decides not to hold any risky assets. King and Leape (1987) also pointed out the importance of information. They reported that more than about 40% of those who did not own stock say that it is because they do not know enough about it. These studies suggest that households who know enough about the stock market or have easy access to information about the stock market hold more risky assets. As for more general knowledge, Mankiw and Zeldes (1991) and Haliassos and Bertaut (1995) reported that the risky asset ratio is higher for highly educated people.

Whether the household owns a house also affects the risky asset ratio. Cocco (2004) revealed by simulation analysis that owning a house has a negative effect on the risky asset ratio owing to the volatility of housing values. Using a Panel Study of Income Dynamics (PSID), Flavin and Yamashita (2002) showed empirically that the risky asset ratio is lower for an owner-occupier than for a non–owner-occupier. Health condition is also an important determinant for asset allocation. Rosen and Wu (2004) showed empirically that the risky asset ratio is higher for healthy people than for the sick.

The investment horizon also affects the risky asset ratio. Poterba and Summers (1988) reported that the variances of the rate of return on stocks become smaller in the long term than in the short term. This means that people whose investment horizon is long can suppress volatility, which induces them to hold more risky assets. Therefore, the risky asset ratio is higher for people with a long-term horizon than for people with a short-term horizon. In fact, Rosen and Wu (2004) reported empirically such an investment horizon effect on the risky asset ratio. Benartzi and Thaler (1995) also pointed out the importance of the investment horizon for risky asset holdings. They showed that the equity premium puzzle exposed by Mehra and Prescott (1985) is explained by loss aversion and myopia, which means that the investment horizon is shorter than a year.

This paper estimates demand function for risky assets using these variables as independent variables: *Unemployment risk*, *Borrowing constraint*, *Self-employed*, *Financial business*, *University*, *Housing*, *Health*, *Investment horizon*. In addition, we use *Age* dummies, *Income*, *Wealth*, and *Child* dummies, and the *TPV*. The expected signs of estimates are shown in Table 4. *TPV* is linear in the estimated relative risk tolerance. Therefore, the estimated coefficients and the significance levels of other variables are the same even if the estimated relative risk tolerance is included as an independent variable in the place of *TPV*. In addition, to use the *TPV* as an independent variable has the advantage of allowing us to reexamine the validity of the classical theory. That is, it allows us to retest the validity of the classical theory by evaluating the estimated coefficient on the *TPV*, even though a mean difference test reveals that the classical theory does not sufficiently explain the observed ratio. A two-censored Tobit model (where the lower bound is zero and the upper bound is one) is used as the dependent variable of the *Ratio* takes a value from zero to one.

Table 3 presents the summary statistics of the variables used for the estimation of the demand function. It also shows that the mean difference test for each variable between the US and Japan reveals significant differences except for *Age40*, *Age70*, *Self-employed*, and *Child aged 22 or younger*. Table 4 reports the estimation results of the demand functions. The marginal effect of the *TPV* is 0.022 in Japan and 0.013 in the US, with both values being significantly different from one. In addition, the marginal effects of many other variables are significantly different from zero. The marginal effects of the *TPV* for both the US and Japan, however, are significantly positive. These results indicate that the observed ratio is not fully explained by the determinants in the classical theory although they partly explain the observed ratio.

5. What Causes the Differential?

In estimating demand function, this study obtains consistent results with previous studies. All the signs of significant coefficients match expected signs. In the sense, the estimation results are reliable to some extent. Decomposition analysis uses the estimation results to explain the differential. Decomposition analysis separate the differential into two components: one that is explained by the difference in the absolute levels of independent variables included in the demand function, and the other that is explained by the difference in the coefficients on the independent variables. The latter represents the difference in the sensitivity of the demand function with respect to each variable.

First, the predicted values of the risky asset ratios for the US and Japan, $\bar{Ratio}^{*,JP}$ and $\bar{Ratio}^{*,US}$, evaluated at the average values of the independent variables $\bar{X}_i$, are calculated. Then, the differential of the predicted value can be decomposed using an arbitrary β_i^* as follows.

$$\Delta \bar{Ratio}^{*} = \bar{Ratio}^{*,US} - \bar{Ratio}^{*,JP}$$
$$= \sum_{i=1}^{M} \left(\hat{\beta}_i^{US} - \hat{\beta}_i^{*}\right)\bar{X}_i^{US} + \sum_{i=1}^{M} \left(\hat{\beta}_i^{*} - \hat{\beta}_i^{JP}\right)\bar{X}_i^{JP}$$
$$+ \sum_{i=1}^{M} \hat{\beta}_i^{*}\left(\bar{X}_i^{US} - \bar{X}_i^{JP}\right) + \hat{\beta}_0^{US} - \hat{\beta}_0^{*}. \#(3)$$

Following Cotton (1988), this study specifies β_i^* as the weighted average of the estimates:

$$\hat{\beta}_i^{C} \equiv \frac{N^{US}}{N^{US}+N^{JP}}\hat{\beta}_i^{US} + \frac{N^{JP}}{N^{US}+N^{JP}}\hat{\beta}_i^{JP}, \#(4)$$

where N^{US} and N^{JP} represents the number of observations in the US and Japan, respectively. By adding $\Delta \bar{Ratio} - \Delta \bar{Ratio}^{*}$ to both sides of equation (3), and substituting $\hat{\beta}_i^{C}$ for $\hat{\beta}_i^{*}$, we obtain:

$$\Delta \bar{Ratio} = \sum_{i=1}^{M} \left(\hat{\beta}_i^{US} - \hat{\beta}_i^{*}\right)\bar{X}_i^{US} + \sum_{i=1}^{M} \left(\hat{\beta}_i^{*} - \hat{\beta}_i^{JP}\right)\bar{X}_i^{JP}$$
$$+ \sum_{i=1}^{M} \hat{\beta}_i^{*}\left(\bar{X}_i^{US} - \bar{X}_i^{JP}\right) + \left(\hat{\beta}_0^{US} - \hat{\beta}_0^{*}\right) + \Delta \bar{Ratio} - \Delta \bar{Ratio}^{*}. \#(4)$$

Equation (5) implies the following. The first and second terms on the right-hand side represent the differential caused by the differences in the sensitivities, which I denote as $sensi_i$ of the variable i. *SENSI* is the sum of $sensi_i$. A positive (negative) $sensi_i$ and *SENSI* indicate that the risky asset ratio for Japanese households is less (more) than that for US households due to the differences in sensitivities. The third term of equation (5) represents the differential caused by the difference in levels, denoting $level_i$ of variable i and the sum of $level_i$ as *LEVEL*. A positive (negative) $level_i$ and *LEVEL* indicate that the risky asset ratio for Japanese households is less (more) than that for US households owing to the differences in the level of the explanatory variables. The fourth term of equation (5), denoting as *OTHER*, is the difference in the constant terms of the US and Japan. *OTHER* represents the differential caused by some factors that are not considered explicitly in the regression. The fifth term is the difference in the residuals denoted as *RESID*.

The estimated values of $sensi_i$ and $level_i$ are shown in Panel A of Table 5. Table 5 shows that the values of $sensi_i$ for the *Investment horizon*, *Income*, *Self-employed*, and *Child* dummies are positive, indicating that the differences in sensitivities of these variables cause the differential. Among them, the *Income* and *Child* dummies have large positive values, meaning that the differences in the sensitivities of the *Income* and *Child* dummies are the main causes of the differential. However, Table 5 also reports that there are many variables with negative $sensi_i$. Negative $sensi_i$ means that the risky asset ratio for Japanese households is higher than that for US households in the light of the differences in sensitivities, suggesting that the differences in sensitivities to these variables does not explain the fact that the risky asset ratio for Japanese households is less than that for US households.

The $level_i$ of the *TPV*, the *Age* dummies except for *Age50* and *Age60*, *Income*, *Wealth*, *Financial business*, *Self-employed*, *Housing*, *Health*, and *Child* dummies are positive. Among them, the *TPV* takes a large positive value. As reported in section 2, there is no statistical difference in the means of the estimated relative risk tolerance and there is little difference in returns on risky assets between the US and Japan. Although the return on safe assets is higher in the US than in Japan, a higher return on safe assets has a negative effect on the risky asset ratio. Therefore, the positive $level_i$ of the *TPV* must be produced by the difference in the variance of the risky asset returns. These results imply that the differential is caused by the higher variance of the risky asset return in Japan. However, there are many variables with negative $level_i$, meaning that the differences in the absolute levels of these variables does not explain the differential in the risky asset ratio.

Panel B of Table 5 reports the values of *SENSI*, *LEVEL*, *OTHER*, and *RESID*, revealing that both *SENSI* and *LEVEL* have negative values, −8.4% and −3.0%, respectively. The negative value of *SENSI* means that the differential is not explained by the differences in the sensitivities. By the same token, the differential is not explained by the differences in the absolute levels of the variables. In contrast, the value of *OTHER* is positive and very large, meaning that a large part of the differential depends on some factors that are not considered explicitly in the regression.

These results suggest that the differential is not explained sufficiently by the difference in either the sensitivity or the level, although this study obtained estimation results of demand functions consistent with previous studies. In other words, a large part of the differential depends on some factors that are not considered explicitly in the regression.

To confirm robustness of the result, this study applies $\hat{\beta}^{OR}$ following Oaxaca and Ransom (1994) instead of $\hat{\beta}^{C}$ [6]. $\hat{\beta}^{OR}$ is expressed as:

$$\hat{\beta}^{OR} \equiv \Omega\hat{\beta}^{US} + (I - \Omega)\hat{\beta}^{JP} \#(6)$$
$$\Omega \equiv (X'X)^{-1}X^{US'}X^{US}$$

where I is the identity matrix, X is the observation matrix for the pooled sample, and X^{US} is the observation matrix for the US sample.

Table 5 reports the result using $\hat{\beta}^{OR}$. *Income*, *Self-employed*, and *Child* dummies have positive $sensi_i$. Among them, the $sensi_i$ of the *Income* and *Child* dummies are large,

[6] In an OLS regression, $\hat{\beta}^{OR}$ coincides with the estimates from the regression with the pooled sample of the US and Japan. However, $\hat{\beta}^{OR}$ in this paper does not coincide fully with that case because this paper used a Tobit model. Nevertheless, the conclusion of this paper is unchanged even if the estimates from the regression with the pooled sample are used in place of $\hat{\beta}^{OR}$.

just as in the case of $\hat{\beta}^{C}$, meaning that the differential is caused partly by the $sensi_i$ of the *Income* and *Child* dummies. The $level_i$ of the *TPV* also has a positive and large value, meaning that the differential is caused partly by the difference in the variance of risky asset returns. Panel B of Table 5 also shows that *SENSI* takes a negative value just as in the case of $\hat{\beta}^{C}$, meaning that the differences in the sensitivities do not explain the differential. On the other hand, the value of *LEVEL* is positive and large. This large value of *LEVEL* seems to explain the differential[7]. However, the value of *OTHER* is about six times as large as the value of *LEVEL*, indicating that the differential is not explained sufficiently by *LEVEL*[8]. In that sense, the result of this study that a large part of the differential depends on some factors that are not considered explicitly in the regression is robust on the value of $\hat{\beta}^{*}$.

6. Conclusion

The ratio of risky assets to wealth is much lower in Japan than in the US. Using a household survey, this paper estimated risky asset demand functions for the US and Japan and attempted to elucidate what causes the differential in the risky asset ratios.

First, by estimating the relative risk tolerances using responses to hypothetical income gambles, this study tested the validity of the risk tolerance hypothesis that the cause of the differential in the risky asset ratios is the differential in attitudes toward risk between the two countries. This study found no statistical difference in the estimated relative risk tolerance between the two countries, indicating that the risk tolerance hypothesis is rejected. Next, this study calculated the value of the risky asset ratio predicted by classical theory and tested whether the observed risky asset ratio is explained sufficiently by the classical theory. It is found that there was a significant difference between the observed and the predicted values, which implies that the classical theory does not fully explain the reality. It also implies that it is likely that some determinants other than those in the classical theory become the cause of the differential in the risky asset ratios. Furthermore, this study estimated risky asset demand functions and decomposed the differential in the risky asset ratio into two components, which correspond to the differences in the sensitivity and in the level. The result was that the differential in the risky asset ratio was not explained sufficiently by

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[7] A positive $level_i$ of the *Investment horizon* means that the values of $\bar{X}_i^{US} - \bar{X}_i^{JP}$ and $\hat{\beta}^{OR}$ take the same signs. It is found that $\hat{\beta}^{OR}$ takes a positive sign because the sign of $\bar{X}_i^{US} - \bar{X}_i^{JP}$ is positive in Table 3. However, a positive $\hat{\beta}^{OR}$ of the *Investment horizon* is inconsistent with the result that the *Investment horizon* takes significantly positive signs in both the US and Japan in the estimation of the risky asset demand functions. This inconsistency may imply that using $\hat{\beta}^{OR}$ is inappropriate. If this puzzling $level_i$ of the *Investment horizon* is removed from *LEVEL*, then the value of *LEVEL* becomes 0.021, which is less than one-tenth of *OTHER*.

[8] The value of *OTHER* does not depend on $\hat{\beta}^{*}$. That is, when using $\hat{\beta}^{OR}$, *OTHER* takes the same value as when using $\hat{\beta}^{C}$. Likewise, the value of *RESID* does not depend on $\hat{\beta}^{*}$.

many economic and demographic variables incorporated into the regression, implying that a large part of the differential in the risky asset ratios depends on some other factors that are not considered explicitly in the regression.

The first candidate for other factors is a cohort effect, which means that an individual's date of birth affects the risky asset ratio through the individual's experience depending on his or her date of birth. Ameriks and Zeldes (2001) argued for this cohort effect and reported that the experience of the Great Depression seemed to restrain US households from holding risky assets. In the sample used in this paper, there are many Japanese people who experienced the collapse of the bubble in the early 1990s, and the experience seems to restrain the Japanese households from holding risky assets. On the other hand, there are a few US households in the sample who experienced the Great Depression in the early 1930s, and this does not seem to restrain the US households from holding risky assets. The differential may be caused by the difference in such experiences. In analyzing the cohort effect, long-term panel data are necessary for identifying the cohort effect and age effect. This is a future task.

The second candidate is loss aversion, a concept proposed by Kahneman and Tversky (1979). Benartzi and Thaler (1995) showed that the equity premium puzzle can be solved by assuming myopic loss averse investors. Their interpretation is that loss averse investors hesitate to hold risky assets as they dislike increases in their frequency of observing losses, which stem from the volatile prices of risky assets. Therefore, the differential in loss aversion, if it exists, will lead to the differential. Estimating the degrees of loss aversion and comparing them between the US and Japan are also future tasks.

The third candidate is related to financial institutions or the supply side, whereas the above two factors were concerned with households or the demand side. Traditionally, the Japanese financial structure centered on indirect financing, whereas the US financial structure, in contrast, centered on direct financing (Cargill and Royama, 1988). This means that the Japanese tend to hold bank deposits and postal savings and Americans tend to hold stocks and bonds. It is probable that such a difference in financial structure causes the differential.

The conclusion of this study is negative in that the risk tolerance hypothesis is rejected and that the main cause of the differential in the risky asset ratios is not the factors that many researchers have proposed as the determinant of the risky asset ratios. I hope that this paper will further stimulate future research on the differential in the risky asset ratios not only between the US and Japan but among other countries.

Appendix 1: Definitions of Independent Variables

- *Unemployment risk* takes a value of unity if the respondent chooses one in answer to the following questionnaire, and zero otherwise.
  - ➢ Do you think there is a possibility that you or someone in your family will be unemployed (in case of running your own business, the possibilities of discontinuing the business) within 2 years?
    1. Strong possibility
    2. Some possibility
    3. Little possibility
    4. Don't know

- *Borrowing constraint* takes a value of unity if the respondent has ever been rejected for a loan application (excluding housing loans), and zero otherwise.

- *Self-employed* takes a value of unity if the respondent is self-employed or a family business employee, and zero otherwise.

- *Financial business* takes a value of unity if the industry in which the respondent works is in the financial or insurance business, and zero otherwise.

- *University* takes a value of unity if the respondent completed college (a bachelor's degree) or is at college, and zero otherwise.

- *Housing* takes a value of unity if the type of home the respondent lives in is his or her own house or condominium, and zero otherwise.

- *Health* takes values of one to five depending on the answers to the following questionnaire.
  - ➢ Does the following statement hold true for you? If "it is particularly true for you", you would choose "1", and if "it doesn't hold true at all for you", you would choose "5". Of course, you may choose any number in between.
    - ✓ I have anxieties about my health.

- *Investment horizon* takes a value of unity if the respondent chooses to answer one, and zero otherwise in the following questionnaire.
  - ➢ How many years ahead do you plan your savings amount per month? The savings amount includes payments for housing loans.
    1. Less than a year
    2. A year or two ahead
    3. 3–5 years ahead
    4. 6–10 years ahead
    5. 11–20 years ahead
    6. More than 20 years ahead

- *Age30* takes a value of unity if the respondent's age is over 30 and under 40, and zero otherwise. *Age40* to *Age60* are constructed in the same way, and *Age70* takes a value of unity if the respondent's age is over 70, and zero otherwise.

- The respondent is required to choose one of 10 categories (e.g., $200,000 to $300,000) into which his or her entire household annual income falls. Based on this choice, upper bound (e.g., $300,000), and the lower bound (e.g., $200,000), and by applying Barsky et al. (1997)'s method, the mean value in each category is calculated. This estimated mean value in each category is used as the *Income* of the respondent. By the same token, the mean value in each category of the balance of financial assets (*Financial asset*) and the present appraised value of all housing and properties are calculated. Then, *Wealth* is constructed by summing the estimated value of the balance of financial assets and the present appraised value of all housing and properties of the respondent. The exchange rate is one hundred yen to the dollar, and the value of *Income* and *Wealth* are represented by yen in millions.

- *Child aged 22 or younger* takes a value of unity if the age of the respondent's youngest child is 22 or younger, and zero otherwise. *Child aged 23 or older* takes a value of unity if the age of the respondent's youngest child is 23 or older, and zero otherwise.

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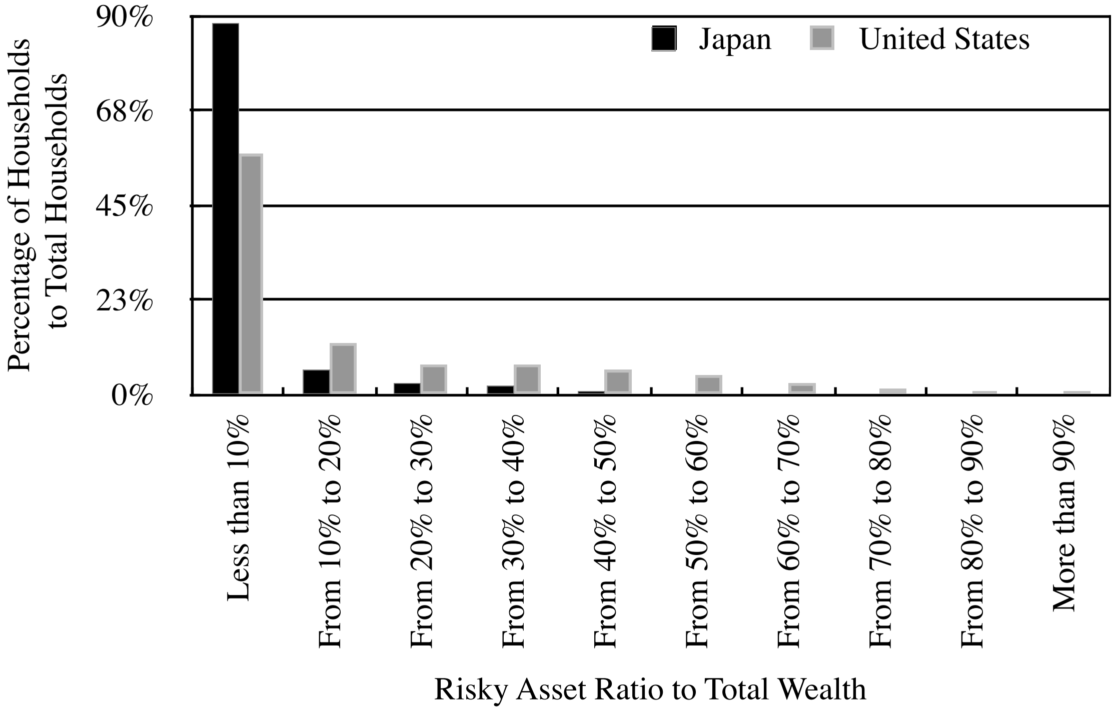

Figure 1. Distribution of risky asset ratio in Japan and the US

Notes: The horizontal axis represents the *Ratio* classified into 10 categories (e.g., 10% to 20%). The vertical axis represents the frequency of the respondents in each category to the total respondents. Black and grey bars represent the relative frequencies in Japan and the US, respectively.

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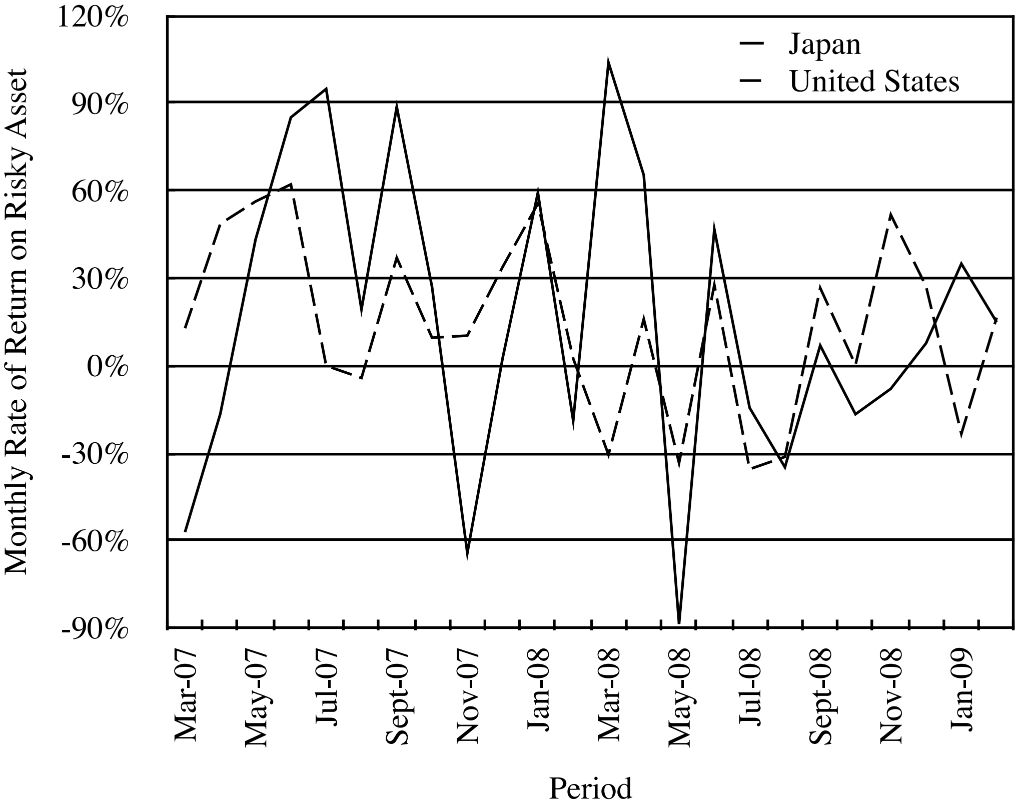

Figure 2. Monthly rate of return on risky assets in Japan and the US

Notes: The figure illustrates the monthly annualized rate of return on the stock price index (setting the annual stock price in 2000 as 100) from March 2003 to February 2005. Solid and dashed line represents the return in Japan and the US. Data on the stock price index are obtained from *International Financial Statistics*. The stock price index in Japan refers to the share prices listed on the Tokyo exchange, and that in the US is produced as a Laspeyres-type index of the Standard and Poors Corporation for the companies in the industrials sector on the New York Exchange. For details, see IMF (2005). The sample period corresponds to the two-year period preceding the implementation of the survey, February 2005. The monthly annualized rate of return on the stock price index is calculated as $12 \times \left(P_t - P_{t-1}\right)/P_{t-1}$, where P_t is the monthly stock price index.

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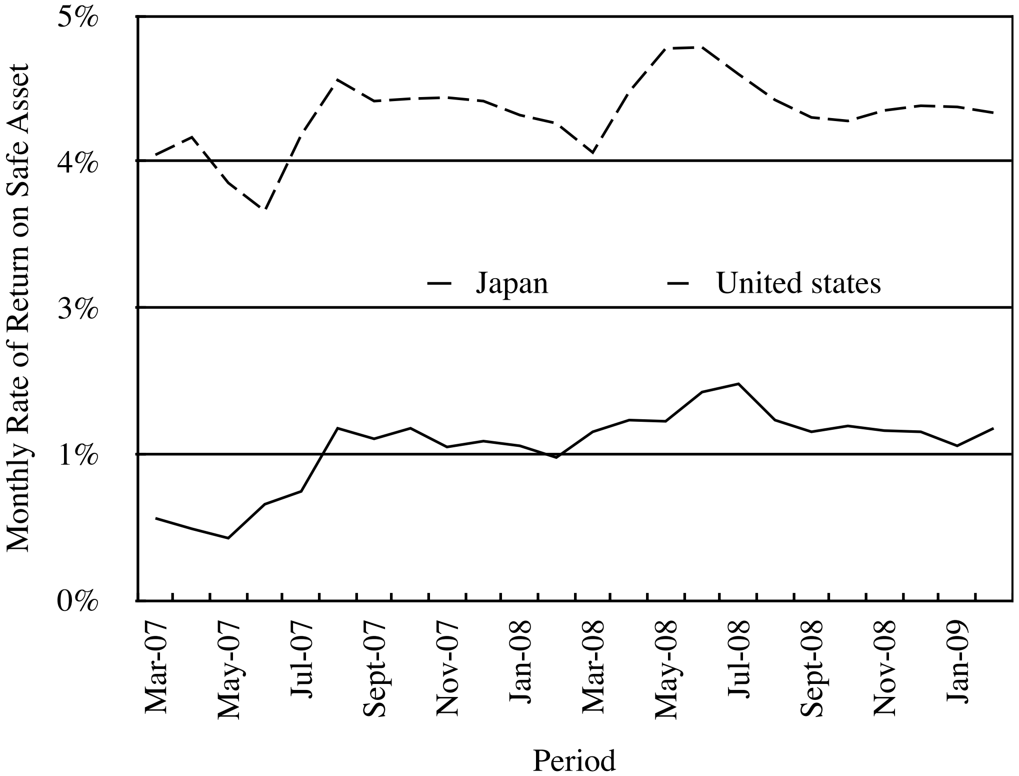

Figure 3. Monthly rate of return on safe assets in Japan and the US

Notes: The figure illustrates the annualized yield on government bonds in the US and Japan. Solid and dashed line represents the return in Japan and the US. Data on the government bond yield are obtained from *International Financial Statistics*. The data refers to 10-year maturities. For details, see IMF (2005).

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Table 1. The risky asset ratio and relative risk tolerance

Panel A. Correlation between the risky asset ratio and relative risk tolerance

Dependent Variable: *Ratio*	Japan		US	
	Coefficient	S.E.	Coefficient	S.E.
Constant	–0.118***	0.009	0.108***	0.008
Relative risk tolerance	0.042**	0.017	0.069***	0.008
Log likelihood	–493.481		–661.256	
Number of observations	1714		1896	

Notes: The table shows the results of regressing the *Ratio* on the estimated relative risk tolerance and the constant term by a Tobit model, where the lower bound is zero (the household holds only safe assets) and the upper bound is one (the household holds only risky assets). Asterisks indicate statistical significance at the 5% (**), and 1% (***) significance levels.

Panel B. The mean difference test for relative risk tolerance between Japan and the US

	Japan	US	Difference
Number of observations	2544	2863	
Mean	0.206	0.215	0.009
Standard deviation	0.349	0.361	0.010

Notes: The means and standard deviations of estimated relative risk tolerance for the US and Japan are shown. There is no significant difference in means between the US and Japan.

Table 2. Theoretically predicted and observed values of risky asset ratios

	Japan			US		
	Number of observations	Mean	S.D.	Number of observations	Mean	S.D.
TPV	2544	0.123	0.209	2863	0.332	0.559
Ratio	1917	0.038	0.097	3029	0.162	0.215
Difference	0.085***			0.170***		

Notes: Means and standard deviations of the theoretically predicted value (*TPV*) and the observed value (*Ratio*) in the US and Japan are shown. The *TPV* is constructed by substituting the estimated relative risk tolerance, the mean return on risky assets and its variance, and the mean yield on government bonds into equation (2). Asterisks indicate statistical significance at the 1% (***) significance levels.

Table 3. Summary statistics

	Japan		US		Difference
	Mean	S. D.	Mean	S. D.	
Ratio	0.036	0.093	0.154	0.206	0.118***
TPV	0.127	0.212	0.300	0.504	0.173***
Unemployment risk	0.195	0.396	0.259	0.438	0.064***
Borrowing constraint	0.075	0.264	0.206	0.405	0.131***
Self-employed	0.088	0.283	0.088	0.284	0.000
Financial business	0.026	0.159	0.085	0.279	0.059***
University	0.248	0.432	0.205	0.404	–0.043***
Housing	0.827	0.378	0.801	0.400	–0.027*
Health	2.756	1.048	3.196	1.160	0.440***
Investment horizon	0.064	0.245	0.534	0.499	0.470***
Age30	0.175	0.380	0.258	0.438	0.083***
Age40	0.234	0.423	0.240	0.427	0.006
Age50	0.256	0.437	0.198	0.399	–0.059***
Age60	0.216	0.411	0.091	0.287	–0.125***
Age70	0.039	0.193	0.034	0.181	–0.005
income	7.123	4.414	7.493	4.853	0.371**
wealth	36.356	41.537	45.874	55.767	9.518***
Child aged 22 or younger	0.473	0.499	0.492	0.500	0.020
Child aged 23 or older	0.338	0.473	0.189	0.392	–0.149***
Number of observations	1466		1178		

Notes: The table shows the summary statistics of the variables used for the estimation of the demand function. The mean, standard deviation, and the number of observations of the *Ratio* in this table are different from those in Table 2 because this study uses samples from those who answered all questions that relate to constructing independent variables. Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) significance levels.

Table 4. Tobit estimation result of the risky assets demand function

	Expected sign	Japan			US		
		Coefficient	Marginal effect	S. E.	Coefficient	Marginal effect	S. E.
Constant		–			0.091**		
TPV	+	0.086**	0.022**	0.008	0.028	0.013*	0.007
Unemployment risk	–	0.012	0.00	0 .00	–	–	0.008
Borrowing constraint	–	–	–	0.006	–	–	0.008
Self-employed	–	–	–	0.005	–	–	0.011
Financial business	+	0.093**	0.028**	0.012	0.03	0.018	0.013
University	+	0.057**	0.015**	0.004	0.049**	0.024**	0.009
Housing	–	–0.026	–0.007	0.005	–	–	0.011
Health	+	0.012	0.003	0.002	–0.006	–0.003	0.003
Investment horizon	–	–	–	0.007	–	–	0.007
Age30	+	0.056	0.015	0.009	0.018	0.009	0.012
Age40	+	0.088**	0.025**	0.010	0.054**	0.026**	0.013
Age50	+	0.105**	0.030**	0.010	0.086**	0.043**	0.015
Age60	+	0.178**	0.055**	0.013	0.094**	0.048**	0.020
Age70	+	0.147**	0.047**	0.018	–0.004	–0.002	0.020
income	+	0.00	0.00	0.000	0.005**	0.002**	0.001
wealth	+	0.001**	0.000**	0.000	0.001**	0.000**	0.000
Child aged 22 or	–	–	–	0.005	–0.001	0.000	0.008
Child aged 23 or older	–	–	–	0.006	0.023	0.011	0.013

Notes: The sample size is 1178 in the US and 1466 in Japan. Standard errors of marginal effects are computed by the delta method (Green, 2003). Asterisks indicate statistical significance at the 10% (*), 5% (**), and 1% (***) significance levels.

Table 5. Decomposition of the differential

Panel A. $sensi_i$ *and* $level_i$

	$\hat{\beta}_i^* = \hat{\beta}_i^C$		$\hat{\beta}_i^* = \hat{\beta}_i^{OR}$	
	$sensi_i$	$level_i$	$sensi_i$	$level_i$
TPV	–0.013	0.010	–0.016	0.014
Unemployment risk	–0.013	–0.001	–0.013	–0.001
Borrowing constraint	–0.003	–0.011	–0.008	–0.007
Self-employed	0.000	0.000	0.000	0.000
Financial business	–0.003	0.004	–0.005	0.006
University	–0.002	–0.002	–0.003	–0.002
Housing	–0.027	0.001	–0.027	0.001
Health	-0.054	0.002	–0.060	0.007
Investment horizon	0.007	–0.024	–0.055	0.038
Age30	–0.008	0.003	–0.008	0.002
Age40	–0.008	0.000	–0.008	0.000
Age50	–0.005	–0.006	–0.006	–0.004
Age60	–0.013	–0.017	–0.016	–0.014
Age70	–0.005	0.000	–0.005	0.000
income	0.023	0.001	0.023	0.002
wealth	–0.001	0.008	–0.004	0.011
Child aged 22 or younger	0.022	0.000	0.022	–0.001
Child aged 23 or older	0.020	0.003	0.016	0.007

Panel B. SENSI, LEVEL, OTHER, and RESID

	$\hat{\beta}_i^* = \hat{\beta}_i^C$	$\hat{\beta}_i^* = \hat{\beta}_i^{OR}$
SENSI	–0.084	–0.172
LEVEL	–0.030	0.059
OTHER	0.327	0.327

RESID	–0.095	–0.095

Notes: The estimated values of $sensi_i$ and $level_i$ of variables i are shown in panel A and The panel B reports the values of *SENSI*, *LEVEL*, *OTHER*, and *RESID*. *SENSI* and *LEVEL* are sums of $sensi_i$ and $level_i$ of variables i, respectively. $\hat{\beta}^{C}$ and $\hat{\beta}^{OR}$ are calculated following by Cotton (1988) and Oaxaca and Ransom (1994), respectively. *OTHER* represents the differential caused by some factors that are not considered explicitly in the regression, and RESID represents the difference in the residuals.